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(54) Title: METHOD OF INHIBITING SAPSTAIN IN WOOD

(57) Abstract

The invention comprises methods of inhibiting sapstain in wood including applying a water barrier over the surface of the wood which is effective to inhibit moisture loss from the wood. The water barrier may be a sheet of plastic or a hydrophobic substance, which may in turn be applied as a water-based emulsion or as a solution in a suitable organic solvent. The method is particularly envisaged for treating freshly cut lumber.

METHOD OF INHIBITING SAPSTAIN IN WOOD

FIELD OF INVENTION

The present invention comprises a method of inhibiting fungal attack generally referred to as sapstain, in wood, particularly in logs while wet after felling. The invention also comprises a composition for use in such a method.

BACKGROUND

When a healthy tree is felled there is a rapid cessation of its immune response to microbial attack. As a consequence felled or sawn timber is susceptible to invasion by sapstain, mould and decay fungi - a large and diverse group of fungi. This attack often results in downgrading of timber, causing serious financial loss in the timber industry. Treatment to prevent such attack by all of such fungi is commonly known as "antisapstain treatment" and normally involves dipping the wood in a fungicidal formulation or spraying such a formulation on the wood surface.

The fungi targeted by antisapstain treatments are in most instances sapstain fungi belonging to the following fungal classification groups: fungi imperfecti (deuteromycetes); ascomycetes; and decay fungi belonging to basidiomycetes. Soft rot fungi belonging to the deuteromycetes and ascomycetes, and decay fungi belonging to the ascomycetes may also be targeted.

A major problem with currently available antisapstain treatments is their failure to give adequate long term performance. This is a particular problem for protecting against sapstain and decay in logs. Under severe storage conditions logs can become unacceptably sapstained within 2 - 4 weeks. Conventional approaches to overcome this problem include application of increasingly higher concentrations of fungicide to the log surfaces; application of adjuvants, sometimes referred to as "wetters" or "stickers" to the fungicidal solutions, that are aimed at increasing effectiveness of the fungicide by improving fungicide uptake by the wood surface; achieving a more even distribution of fungicide on the surface; reducing susceptibility of the fungicide(s) to wash-off; improving contact between fungus and fungicide; aiding fungicide uptake by the fungus, and/or by

physico-chemical interaction with the fungicide and fungus at the molecular and cellular level in such a way that the potency of the fungicide is increased; and application of water-repellents designed to increase the rate of drying of timber exposed to rain, by preventing, or reducing the extent of, rewetting of timber that has started to dry.

These approaches can in some instances achieve improved long term performance of antisapstain treatments, but the extent to which this occurs is limited, particularly in the case of freshly felled and debarked logs.

When a tree is felled a large proportion of the sapwood is at saturated moisture content or close to saturation point. For example, for radiata pine the moisture content typically ranges from 120 - 200% of the timber's dry weight (dw), depending on the wood density. If the sapwood remains saturated, penetration of sapstain fungi is largely prevented. In some countries logs are placed in ponds or under water sprinklers to prevent drying and subsequent infection by sapstain fungi. However, this method of preventing sapstain cannot be used for logs that are being transported, or where a ready supply of water is not available because continuous application of water is required. Alternatively loss of moisture from timber can be reduced by covering the wood with impermeable sheets. For example log piles can be covered with tarpaulins, however this raises the humidity of the air around the timber surface and greatly increases its susceptibility to mould fungi. Commercial antisapstain formulations used currently do not control mould growth under these conditions.

The present invention provides an improved or at least alternative method of protecting wet wood against such biodeterioration. It is believed the method of the invention provides protection for a longer term than obtained by methods currently in use, without requiring subsequent treatment with water such as by water sprinkling.

SUMMARY OF INVENTION

In broad terms the invention comprises a method of inhibiting sapstain in wood comprising applying a water barrier over the surface of the wood which is effective to inhibit moisture loss from the wood.

Preferably the water barrier is a liquid or is in the liquid phase.

Preferably the method comprises applying one or more hydrophobic substances over the surface of the wood to form the water barrier.

Preferably the water barrier is formed of a solid, flexible material.

Preferably the solid, flexible material is a plastics film.

Preferably the method also includes applying a biological control agent or a fungicide over the surface of the wood.

Preferably the hydrophobic substance and/or biological control agent/fungicide treatment composition(s) are applied by spraying or dipping.

Preferably the wood is treated before its moisture content has fallen below about 80% saturation and more preferably before its moisture content has fallen below about 90% saturation. Preferably freshly cut logs are treated within three days of cutting and more preferably within one or two days of cutting, after stripping the logs of bark.

Preferably the water barrier is a hydrophobic substance such as wool grease. Other suitable substances that may preferably be used as the water barrier include lanolin, petrolatum, paraffin oils, fish oils such as shark oil, animal oils, waxes, silicones, fatty acid esters, bitumen and vegetable fats and oils.

In broad terms the invention is also directed to an antisapstain composition of use in the prevention of sapstain in wood, the composition comprising between about 10% and about 40% of a water barrier substance and between about 60% and about 90% of either an organic solvent, or water or a water based composition.

Preferably the organic solvent is a liquid hydrocarbon or mixture of liquid hydrocarbons.

Preferably the organic solvent is kerosene, benzene, chloroform, toluene, ether, carbon disulfide, acetone, paraffin, diesel, white spirit, soya oil, linseed oil, or shark oil.

Preferably the water based composition further includes a surfactant.

Preferably the water based antisapstain composition is an emulsion.

Preferably the antisapstain composition further includes a fungicide and/or a biological control agent.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is directed to a method of inhibiting sapstain in wood. The preferred method comprising applying over the surface of the wood, a water barrier material that inhibits moisture loss from the wood.

The best theoretical water barrier system is one which is highly durable, resistant to damage from abrasion, and which provides a water barrier that is close to 100% effective whilst remaining cost effective. The water barrier used should minimise moisture loss from the wood which occurs soon after felling of the timber. Thus the water barrier should inhibit water vapour loss from the wood. A further future is that a water-barrier layer will also minimise the effect of wash-off of conventional antisapstain treatments if those are used in conjunction with the water-barrier treatment of the present invention.

Shrink-wrap plastic sheaths, as are known in the art, can be used to provide a highly effective water barrier which will prevent almost all moisture loss. The plastic sheath is placed over the whole log, as soon after felling as possible, to retain the moisture. The use of such plastic sheaths is within the scope of the invention.

Preferably the method consists of applying a water barrier as a liquid or in a liquid phase, which plugs the wood either immediately during drying or some time after drying. Most of the substances that are suitable are hydrophobic. The most preferred material for use as a water barrier that can be applied in this way is wool grease. Other materials that can

be used include waxes, lanolin, petrolatum, paraffins, silicones, bitumin, fatty acid esters and animal vegetable fats and oils. Fish oil such as shark oil can also be used. Any substance that can be applied cost effectively and forms an effective, durable and abrasion resistant water barrier can be used. Hydrophobicity, while preferable, is not essential.

Wool grease is the preferred substance for use as the water barrier or in the water barrier composition. Wool grease can be obtained by washing raw wool with a non-ionic surfactant (usually nonyl phenyl ethoxylate) in water, to remove the wool grease. The wash is then centrifuged which results in the raw wool grease separating from the water/surfactant mixture. Wool grease can however be removed from wool by any method known in the art and is a by-product of the wool-scouring process.

Sufficient water barrier material should be present to form a barrier to plug the open structure of the wood. The amount of water barrier material deposited on the surface of the wood depends not only on concentration, but also on viscosity. Higher loadings can be achieved with more viscous solutions. If desired the rheological characteristics such as the viscosity of the formulation can be adjusted to achieve the higher loadings on the surface of the wood. Thixotropic liquids are preferred.

The hydrophobic substance used as the water barrier may alternatively be applied to the wood without any dilution with a carrier. Wool grease may be so applied for example, but may require heating until a consistency at which the wool grease may be readily applied is obtained. Preferred water barrier compositions contain 10-40% (w/w) and more preferably 15-25% of a water barrier hydrophobic substance.

The invention also includes an antisapstain composition comprising 10-30% of a water barrier substance such as wool grease and 70-90% of a liquid hydrocarbon such as kerosene, and an antisapstain composition comprising 10-30% of the water barrier substance (eg wool grease) and 0.5-5% surfactant and 65-84.5% water.

If a biological control agent (BCA) or fungicide is used this may be applied to the wood and then the water barrier composition applied. Alternatively, in the case of the use of liquid or liquid water barrier materials, the BCA or fungicide and the water barrier material may be applied together. Another alternative when using such water barrier

material is to first apply a BCA or fungicide and then apply a second composition comprising the water barrier material and a BCA or fungicide. Also, it is possible to first apply the water barrier and then the BCA/fungicide as the BCA/fungicide will move through the water barrier over time.

Preferred fungicides include- substituted benzimidazoles such as carbendazim (methyl benzimidazol-2-ylcarbamate), chemical precursors of benzimidazoles such as benomyl (methyl 1 -(butycarbonyl) benzimidazol-2ylcarbamate or copper-8- hydroxyquinolinolate; triazoles such as hexaconazole ((RS)-2-(2,4-dichlorophenyl)- 1 -(1 H- 1,2,4-triazole-1-yl) hexan-2-ol); quaternary ammonium compounds such as didecyl dimethyl ammonium chloride; chlorothalonil (tetrachloroisophthalonitrile); and boron compounds such as alkanolamine borates, timber (approximates to $Na_2B_8O_{13}4H_2O$) and borax (sodium tetraborate decahydrate). Any suitable fungicide may be used, preferably having low toxicity to organisms other than the targeted fungi, and which will preferably degrade rapidly in the environment but persist for the required length of time on timber. The fungicide may be used alone or in combination with any other fungicide to increase fungicidal effectiveness. An enhancement of performance can be achieved by the addition of a co-biocide or mixture of co-biocides (a chemical that enhances the performance of the primary fungicide) such as carbendazim or hexaconazole.

The water barrier protects the "envelope" of fungicide on the wood surface from wash-off, reducing depletion of the (fungi) toxicity, and also reducing contamination of the environment. The water barrier also prevents rapid drying that can cause checks and cracks in the wood surface which would in turn form a breech in the "envelope" of fungicide, and that can also cause depletion of the concentration of fungicide on the surface. The water barrier may also prevent the incidence of fungal growth on the surface of wood by encapsulating water soluble nutrients present on the surface and/or decreasing the availability of oxygen. The water barrier maintains the moisture content of the surface wood layers thereby maintaining the mobility of the fungicides, maintaining their availability and toxicity to fungi.

Preferred BCA's of use include non-pigmented strains of *Ophiostoma piceae* and *Trichoderma harzianum* and the bacteria *Bacillus subtilus*. Further BCA's as will be known to a skilled person may also be used such as *Trichoderma viride* or *Scytalidium lignicola*.

A particular benefit of using the invention with biological control agents (BCA's), such as, for example, non-pigmented strains of *Ophiostoma piceae* and *Trichoderma harzianum* and the bacteria *Bacillus subtilus*, is that the water barrier forms a protective seal over the BCA. The water barrier then greatly reduces the incidence of fungal growth on the surface of the wood, reducing the competition encountered by the BCA. In addition wood, especially logs, often dries very unevenly so that regions of relatively dry wood are often in close proximity to wet wood. When a BCA such as non-pigmented *Ophiostoma piceae* is applied to the surface of wood its ability to colonise the wood is directly related to the rate at which wood moisture drops to suitable levels. If wood moisture content at any given time is very uneven then the rate of colonisation of the wood will also be uneven.

If a water barrier is applied to the surface of the timber the drying is much more even and the colonisation by the BCA is also more even. This is likely to result in a more efficient treatment.

Preferably the method comprises applying the hydrophobic substance as an aqueous emulsion or as an organic solvent based composition.

Organic solvents have the advantage that they allow ease of application while, in preferred cases, the solvent will completely or partially evaporate leaving a layer of the water barrier substance on the log. It is not essential that the solvent used evaporates however this is preferred. The organic solvent is preferably kerosene or commercially available hydrocarbon solvents such as Certrex 46 (available from Mobil) but can be any suitable liquid hydrocarbon as will be known in the art. Compositions formed with molten fat or grease can also be used. Suitable organic solvents will also include, benzene, chloroform, toluene, ether, carbon disulfide, acetone, paraffin, diesel, white spirit, soya oil, linseed oil, shark oil.

Preferably, in the case of an aqueous formulation, the emulsion composition may also comprise a surfactant or surfactants to enable the hydrophobic phase to form a stable emulsion in water. Preferred surfactants include fatty amine salts and in particular tallow propylene diamine acetate. However other primary, secondary or tertiary amines and/or their ethoxylates may be used which are neutralised with an acid such as acetic, citric, sulphuric acid or similar. The neutralised amine would then be combined with a nonionic surfactant preferably a sorbitan ester or sorbitan ester ethoxylate or an alkyl phenol ethoxylate.

The aqueous emulsions may optionally be further stabilised with the addition of a protective colloid in the aqueous phase such as hydroxy propyl methyl cellulose, or other similar compounds may be used e.g. methyl cellulose, starches or various gums or other water soluble polymers.

In addition other components may also be added. These will include pH adjusting chemicals; microbiocides as a preservative (e.g. 2-n-octylisothiazolin-3-one, lactic acid, 1,2-dibromo-2,4-dicyanobutane); rheological modifiers (eg poly vinyl alcohol, poly vinyl acetate, polyethylene glycol); thickeners (eg Xanthan gum, colloidal clays, hydroxethyl cellulose or carboxymethyl cellulose); anticorrosion chemicals (e.g. phosphates, borates, bromates); and antioxidants (eg butylated hydroxy toluene (BHT), irganox 1010). Where a BCA is present in the composition the other components of the composition are chosen so as not to be toxic to the BCA.

We have found that once logs start to lose moisture after felling they become increasingly susceptible to infection by sapstain and decay fungi. We have found a positive correlation between falling moisture contents and increasing rates of penetration of sapstain fungi into timber, causing sapstain. Whilst the exact relationship between moisture content and rate of sapstain penetration is not known, for New Zealand radiata pine infected with the sapstain fungi *Ophiostoma piceae* and *Diplodia pini*, laboratory results suggest that once the timber moisture content falls below about 80 to 90% of that contained in the wood at saturation (% (sat)), sapstain penetration rates increase significantly.

Our antisapstain log trials suggest that commercially available fungicidal treatment can prevent sapstain fungi from causing sapstain if timber moisture contents remain high, but that once a certain amount of moisture has been lost the treatment fails. If drying conditions are severe, such as occur on a windy and warm summer day (e.g. 25°C, 75% relative humidity (RH) and moderate wind speeds) moisture loss is rapid and the currently available commercial antisapstain treatment fails quickly. The method of the present invention minimises this moisture loss and results in continued effective results.

The application of the liquid or liquid phase water barrier to the log can be via any suitable means as will be known in the art. Conventional pressurised sprayers, such as paint sprayers or the like, can be used for example. Alternatively the logs can be dipped or otherwise immersed into the water-barrier composition.

The following examples further illustrate the invention. All ratios, percentages and proportions are stated by weight.

EXAMPLE 1

Preparation of Water Barrier Composition

A water barrier composition comprising wool grease emulsion was prepared as follows. A premix of 20 parts wool grease and 1.8 parts tallow propylene diamine and 0.5 parts of sorbitan monostearate at 65°C was added to a water solution of 0.6 parts acetic acid and 0.4 parts hydroxy propyl methyl cellulose, at 60-65°C with speed agitation and stirred until cooled below 45°C. Then a small quantity of a suitable preservative such as 0.02% Kathon LX was added. The composition is then made up with about 77 parts water.

EXAMPLE 2

Preparation of Water Barrier Composition Containing a Fungicide

A water barrier and fungicidal formulation was prepared as follows. A solution A of 1 part of cyproconazole to 4 parts of N-methyl pyrrolidine was prepared. Then solution B of 1 part of carbendazim to 5 parts of lactic acid at 50°C was prepared.

A solution C was then prepared by mixing of 1 part of didecyldimethyl ammonium chloride and 1 part of nonyl phenol ethoxylate to 3 parts of solution A, and then 1 part of this mixture was added to 3 parts of solution B.

One part of solution C was then added to 50 parts of the wool grease emulsion of Example 1.

EXAMPLE 3

Log billet antisapstain trials were conducted to compare the efficacy of water barrier treatments with and without fungicides, with commercially available antisapstain treatments. Radiata pine logs were stripped of bark approximately 5 hours after felling, cut into 1 metre long billets and dipped in the following treatments approximately 8 hours after felling:

1. Water (*control*).
2. A commercial antisapstain formulation containing 0.3% w/w carbendazim plus 0.3% w/w copper-8 hydroxyquinolinolate (*Cu+Carb*).
3. An emulsion containing 40% w/w of wool grease (*EWG40*).
4. A commercial antisapstain formulation containing 0.3% w/w carbendazim plus 0.3% w/w copper-8 hydroxyquinolinolate followed by (after 5 minutes) an emulsion of 40% w/w wool grease (*EWG 40 + (Cu+Carb)*).
5. A commercial antisapstain formulation containing 0.3% w/w carbendazim plus 0.3% w/w copper-8 hydroxyquinolinolate followed by (after 5 minutes) molten (100%) wool grease (MWG) at 55°C (*MWG + (Cu+Carb)*).

Fifteen replicate billets of each of treatments 1, 2 and 5 were stored in a room at 25°C and 75% RH (warm) for 8 weeks prior to assessing for the extent of sapstain. Treatments 1, 2, 3 and 4 were pyramidally stacked in a pole barn at ambient temperature (February - May, Rotorua, New Zealand) and left for 16 weeks. After storage the billets were cut transversely into 5 biscuits and the four unique cross-cut faces were assessed for depth of sapstain penetration and percentage cover of sapstain. Mean values for each treatment were derived. The results are given in Table One.

Table One: Extent of Sapstain in Log Billets.

TREATMENT NUMBER	TREATMENT	EXPOSURE REGIME	EXPOSURE PERIOD	INTERNAL SAPSTAIN			
		WEEKS		% COVER		PENETRATION (MM)	
				MEAN	SD	MEAN	SD
1	*Control*	Ambient	16	35	23	72	21
1	*Control*	Warm	8	56	8	78	6
2	*Cu+Carb*	Ambient	16	8	5	23	15
2	*Cu+Carb*	Warm	8	4	2	25	7
3	*EWG40*	Ambient	16	3	2	7	6
4	*EWG40+ (Cu+Carb)*	Ambient	16	1	1	1	1
5	*MWG+ (Cu+Carb)*	Warm	8	0.2	0.3	0.4	0.7

Statistical analysis of sapstain penetration data showed that molten wool grease plus the commercial treatment (treatment 5) gave significantly better (5% level of probability) protection than the commercial treatment after 8 weeks storage at 25°C and 75% RH. For 16 weeks storage at ambient temperature EWG40 gave significantly (5% level of probability) better protection than the commercial treatment. EWG40 plus the commercial treatment gave significantly better protection than EWG40 alone.

Measurement of moisture loss from billets during the above studies showed a strong positive correlation between moisture loss and the extent of sapstain, as given in Table Two.

Table Two: Weight Loss Data

TREATMENT NUMBER	TREATMENT	EXPOSURE REGIME (WEEKS)	EXPOSURE PERIOD	% WEIGHT LOSS
1	*Control*	Ambient	16	43
1	*Control*	Warm	8	41
2	*Cu+Carb*	Ambient	16	48
2	*Cu+Carb*	Warm	8	49
3	*EWG40*	Ambient	8	9
4	*EWG40+ (Cu+Carb)*	Ambient	8	5
5	*MWG+ (Cu+Carb)*	Warm	8	3

Whilst the maximum mean moisture loss that can occur before the billets become highly susceptible to sapstain is not known exactly the results suggest that it lies between 10 and 20% (approximately 5 to 10% weight loss). If a water barrier is to be used alone and is to provide a level of protection close to 100% effective, then the sapwood must be kept at near saturation point by the water barrier. Since this is difficult to achieve a combined treatment of water barrier plus fungicide and/or BCA is recommended.

The exact thickness of wool grease that is required to provide a water barrier of the appropriate effectiveness is not known but a laboratory study of the effect of thickness on moisture loss showed that there was no significant difference between layers of about 0.5 and about 3 millimetres thickness. Whilst about 0.5 millimetres was the thinnest layer tested in this study billet trials in general showed that when the layer was less than about 0.5 millimetres thickness the effectiveness of the water vapour barrier decreased as determined by the extent of sapstain after storage.

EXAMPLE 4

Preparation of Water Barrier Compositions

(i) Wool grease is heated to a temperature above 50°C prior to dipping or spraying. If dipping is the application method the thickness of the layer of wool grease applied can be manipulated by the temperature. Radiata logs at ambient temperature dipped in wool grease at 55°C for 3 seconds resulted in a thickness of 3 millimetres. Radiata logs dipped in wool grease at 80°C resulted in a thickness of 0.5 millimetres. Both thicknesses are suitable for use in the method of the present invention.

(ii) Molten wool grease was mixed with varying proportions of kerosene to achieve a liquid at ambient temperature that could be applied through a conventional pressurised paint sprayer. The minimum quantity of kerosene that could be used with the paint sprayer was found to be approximately 50%.

(iii) Wool grease was mixed separately with shark oil, paraffin and linseed oil in ratios of 1:1, 1:1.25, 1:1.5 and 1:2 to determine which mixture had the most appropriate rheology and viscosity for spray application. All mixtures of the ratio 1:2 had a viscosity low enough for spray application.

(iv) The following mixtures were stable for 7 weeks at ambient temperature: wool grease at 50%, 40%, 30%, 20% and 10% dissolved into paraffin, kerosene, diesel, white spirit, soya oil, linseed oil and shark oil (after 7 weeks the stable mixtures were discarded). The following mixture was stable for 27 weeks at ambient temperature; 33% wool grease plus 67% white spirit.

After application to wood the solvent component of the following solvent plus wool grease mixtures completely or partially evaporates leaving a coating of wool grease; 33% wool grease plus 67% kerosine, 33% wool grease plus 67% white spirit.

(v) Water based Formulation

Components	%	
Wool Grease	42.5	
Sorbitan monostearate	0.53	phase A
Tallow propane diamine	3.83	
POE 20 Sorbitan monostearate	0.53	
water (hot)	51.3	phase B
Acetic 75%	3.8	
Kathon LX	0.02	
TOTAL	100	

Procedure:

1. Heat phase A to 65°
2. Heat phase B to 60-65°C
3. Add phase A to phase B while mixing then homogenise for 30 minutes.
4. Add Kathon LX and continue slow mixing until batch is cooled to 40°C.

(vi) Solvent Based Formulation

Components	%
Wool grease	66.7
High aromatic hydrocarbon solvent	33.3 (eg Mobil's Certrex 46)

Procedure:
Heat wool grease till fluid (ie approx 40°C)
While mixing, add solvent.

Whilst wool grease is the preferred water barrier other materials can be liquified and/or given the appropriate viscosity and rheology in the same way.

The foregoing describes the invention. Variations and modifications as will be obvious to those skilled in the art are intended to be incorporated within the scope hereof as defined in the claims.

CLAIMS

1. A method of inhibiting sapstain in wood comprising applying a water barrier over the surface of the wood to inhibit moisture loss from the wood.

2. A method according to claim 1 wherein the water barrier is applied as a liquid or in the liquid phase.

3. A method according to claim 1 or 2 wherein the water barrier is formed by a hydrophobic substance.

4. A method according to claim 1 wherein the water barrier is formed by applying a film of a plastics material over the surface of the wood.

5. A method according to any one of claims 1-3 further including applying a biological control agent and/or a fungicide over the surface of the wood.

6. A method according to claim 5 wherein said hydrophobic substance(s) and said biological control agent and/or fungicide are applied together as a single composition.

7. A method according to claim 5 including first applying said fungicide and/or biological control agent to the wood and then applying said water barrier.

8. A method according to any one of claims 1 to 7 wherein the wood has a moisture content of greater than about 80% saturation.

9. A method according to any one of claims 1 to 7 wherein the wood has a moisture content of greater than about 90% saturation.

10. A method according to claim 3 wherein said hydrophobic substance is applied to the wood in the form of an aqueous emulsion.

11. A method according to claim 3 wherein said hydrophobic substance is applied to the wood in an organic solvent based composition.

12. A method according to claim 11 wherein said organic solvent is a liquid hydrocarbon or mixture thereof.

13. A method according to claim 11 wherein said organic solvent is kerosene, benzene, chloroform, toluene, ether, carbon disulfide, acetone, paraffin, diesel, white spirit, soya oil, linseed oil, or shark oil.

14. A method according to claim 1 or 2 wherein said water barrier comprises raw wool grease, lanolin, petrolatum, a paraffin oil, a fish oil, an animal oil, a wax, a silicone, a fatty acid ester, bitumen, or a vegetable fat or oil.

15. A method according to claim 14 wherein said water barrier comprises raw wool grease.

16. A method according to claim 1, 2 or 3 wherein the water barrier comprises 10-40% by weight of the total composition which is applied to the wood.

17. A method according to any one of claims 5 to 16 wherein said fungicide is selected from a substituted benzimidazole, a precursor of a benzimidazole, a triazole, a quaternary ammonium compound, or a boron compound.

18. A method according to claim 10 further including the application of a fatty amine salt and/or ethoxylate surfactant.

19. A method according to claim 1, 2 or 3 wherein said water barrier is applied to the wood by dipping or spraying.

20. An antisapstain composition comprising 10-30% of a water barrier substance and 70-90% of an organic solvent.

21. An antisapstain composition comprising 10-30% of a water barrier substance and 0.5-5% surfactant and 65-84.5% water.

22. A composition according to claim 20 or 21 wherein the water barrier substance is wool grease.

23. A composition according to claim 20 wherein the organic solvent is a liquid hydrocarbon.

24. A composition according to claim 20 wherein the organic solvent is kerosene, benzene, chloroform, toluene, ether, carbon disulfide, acetone, paraffin, diesel, white spirit, soya oil, linseed oil, or shark oil.

25. Wood treated by a method or with a composition according to any one of the preceding previous claims.